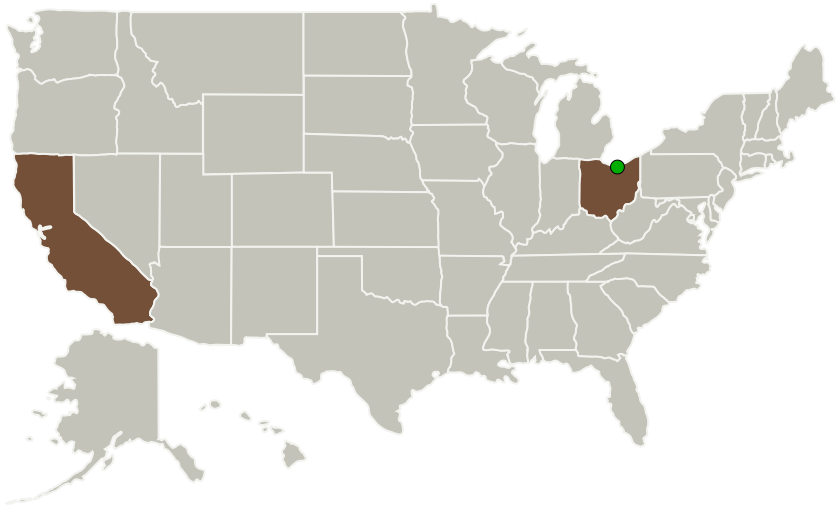
Flexible Transfer of Regolith in Micro-Gravity and Vacuum, Phase I

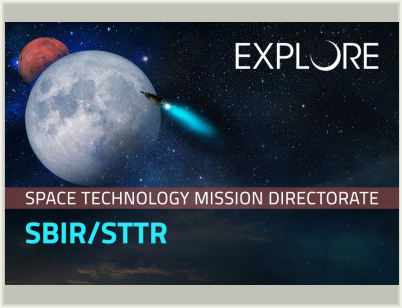
Completed Technology Project (2012 - 2012)

Project Introduction

A novel, robust method of collection and transfer of NEO/Phobos material under micro-gravity conditions under vacuum/space environment with minimal loss of volatiles will be developed and its feasibility demonstrated. The same designs can also be utilized in lunar or Martian applications with only minor modifications. Design of the light-weight flexible conveyor ducts will utilize recently verified regolith simulation software to assure that the concepts are viable under microgravity conditions, and prototypes will be tested under vacuum conditions in Phase-1 (and under micro-gravity during Phase-2). Depending on the drill-head/feeder design selected, these flexible transfer ducts could be used in extraction of material from depths of a meter or more below the surface. Under Martian conditions a 1-cm-diameter conveying duct could deliver 5 kg/hr of material to a processing station for extraction/processing of volatiles. Trade-off studies during Phase-1 will determine potential power saving (if any) in larger diameter conveying ducts (e.g., 1.5 or 2cm dia) and/or the power requirements in a smaller diameter conveying duct (e.g. 0.5 cm dia) under Martian conditions. Unlike conventional screw conveyors, these flexible transfer ducts would be robust to oversize material up to a size of one-half the transfer duct radius. Coupled with an oversize-rejection inlet feeder, the system could provide high reliability transfer of loose regolith with one or two major moving parts. Modular designs are possible, as is the incorporation of energy-efficient ultrasonic (or percussion) drill heads, or sensors near a sub-surface inlet.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
Grainflow Dynamics, Inc.	Lead Organization	Industry	Livermore, California
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
California	Ohio

Project Transitions

February 2012: Project Start

August 2012: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138170)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Grainflow Dynamics, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

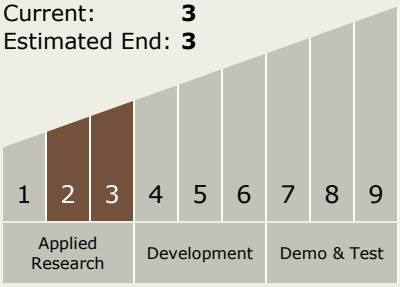
Carlos Torrez

Principal Investigator:

Otis R Walton

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



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Technology Areas

Primary:

- TX07 Exploration Destination Systems
  - TX07.1 In-Situ Resource Utilization
    - TX07.1.1 Destination Reconnaissance and Resource Assessment

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System